The 2nd Workshop on Hacking and Making at Time-Bounded Events

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Abstract

In hackathons, small teams work together over a specified period of time to complete a project of interest. Such time-bounded hackathon-style events have become increasingly popular across different domains in recent years. Collegiate hackathons, just one of the many variants of hackathons, that are supported by the largest hackathon league[1] alone attract over 65,000 participants among more than 200 events each year. Variously known as data dives, codefests, hack-days, sprints, edit-a-thons, mapathons, and so on, such events vary depending on different audiences and with divergent aims: for example, whether teams know each other beforehand, whether the event is structured as a competition with prizes, whether the event is open or requires membership or invitations, and whether the desired outcome is primarily a product innovation, learning a new skill, forming a community around a cause, solving a technical problem that requires intensive focus by a group, or just having fun. Taken together, hackathons offer new opportunities and challenges for collaboration by affording explicit, predictable, time-bounded spaces for collaborative work and engaging with new audiences. With the goal of discussing opportunities and challenges surrounding hackathons of different kinds, this one-day workshop brought together researchers, experienced event organizers, and practitioners to share and discuss their practical experiences. Empirical insights from studying these events may help position the CHI community to better study, plan and design hackathon-style events as socio-technical systems that support new modes of production and collaboration.

[1] Major League Hacking, https://mlh.io/

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Introduction

In recent years, there has been a surge in popularity of time-bounded intensive events. These events - which are generally known as hackathons - typically engage enthusiasts in small ad-hoc teams to create artifacts - most commonly software prototypes - over a period of 1 or 2 days, motivating them with competitive awards such as prizes and job offers [3, 17]. Hackathons or similar collaborative events are often termed as data dives, codefests, hack-days, sprints, edit-a-thons, mapathons, etc. The popularity of hackathons has increased dramatically and that, for example, collegiate hackathons, just one of the many variants of hackathons, are able to attract over 65,000 participants across 200 events each year[1].

The hackathon model is applied across fields. Examples include informal and collaborative learning [10, 15, 20], creating startups [6], arts and culture [3], civic open innovation [1], corporate innovation [16, 17], computational biology [14, 19], and social issues [18]. It has also been used in academic conferences through workshops exploring alternative models of creation such as OCData Hackathon at CSCW [11], and CHI4 Good Day of Service [18] and Crowdcamp [2] at CHI. These hackathons may differ on the interaction style (competition or collaboration), the mode of collaboration (face-to-face or remote), the extent to which communication tools are used[2], whether newly formed or existing communities working on new or existing projects [13, 14, 16, 17], and goals and orientation (community building or advancement of existing projects) [5, 7].

Hackathon-style events introduce new and interesting opportunities as well as challenges for the study of collaborative work. For example, these events may provide unique opportunities for cooperation by affording explicit and time-bounded spaces for individuals to work more interdependently; access to new collaborators with needed background and experience, and existing collaborators who are otherwise difficult to reach [20]; predictable interactions that can serve to strengthen existing social ties and develop new ones [14]. At the same time, working on projects that are outside of one's normal workflow may provide challenges for continuity after the brief cooperative stint is over [20]. For example, continuing projects in a virtual setting may

[2] Mozilla Science Lab Global Sprint 2016. https://science.mozilla.org/programs/events/global-sprint-2016

require carrying over social and work artifacts that are not in easily editable formats and highly context dependent [15], and keeping momentum and enthusiasm for completing projects presents a further challenge [13]. These events may also provide different pressures on team dynamics process. For example, team formation and common understanding need to happen relatively quickly.

Despite the plethora of research and public attention, little is known about how to design a hackathon to achieve intended outcomes, what benefits hackathons offers, what the immediate and longer-term impacts of hackathons are, and what the larger impacts of hackathons on CHI community and on the society as a whole are. To fill these gaps, we conducted our first workshop[3] on this topic at the 2017 ACM conference on Computer Supported Cooperative Work (CSCW 2017) [8] which the current workshop is built upon. There we brought together researchers and practitioners to share their hackathon-related experiences. The outcomes of our previous workshop were reported in a technical report, and distributed to all workshop participants. Building on our successful first workshop, we conducted the hackathon workshop for the second time at the 2018 ACM CHI conference on Human Factors in Computing Systems (CHI 2018) in order to continue with the discussions about the open issues that were identified in our first workshop and build the community of researchers and practitioners with an interest in hackathons.

This report presents an account of the one-day workshop[4] at the CHI 2018 which brought a diverse set of researchers and practitioners including past event organizers and individuals interested in organizing events in the future. In the remainder of this report, we describe the format of the workshop, including preparation and post-workshop activities, and summarize poster presentations and results of discussion sessions which took place during the workshop.

Workshop

On Sunday, April 22, 2018 the "2nd Workshop on Hacking and Making at Time-Bounded Events: Current Trends and Next Steps in Research and Event Design" took place at the Palais

[3] The CSCW 2017 workshop on hacking and making at time-bounded events. https://hackathon-workshop.github.io
[4] The CHI 2018 workshop on hacking and making at time-bounded events. http://hackathon-workshop-2018.com

des Congrès de Montréal in Montreal, Québec, Canada. The workshop was held in conjunction with the 2018 ACM CHI Conference on Human Factors in Computing Systems (CHI 2018).

This workshop had four main objectives:

- Facilitate networking between CHI and CSCW scholars and practitioners (both those who have experience organizing events and those who are curious about doing so),
- Develop an understanding of how to situate time-bounded events in the broader context of CHI and CSCW methods and theory,
- Identify and compile recommendations for organizers of events, as well as important tradeoffs, and
- Explore future directions for research in this area, including publication venues.

Workshop Format

Pre-Workshop Activities

This workshop was led by an 8-person organizing committee comprising both researchers working in the fields of CHI and CSCW, and practitioners with experience organizing events. We also informed and invited organizers and participants from our previous workshop as well as other potentially interested individuals to help us organize this second workshop. We specifically aimed to have both researchers and practitioners in this the organizing committee in order to bring multiple perspectives to bear on event organization and advertisement, and participant recruitment and selection.

CHI and CSCW researchers on the committee came from the Institute for Software Research at Carnegie Mellon University and Northwestern University. Practitioners on the committee came from the Harvard T.H. Chan School of Public Health at Harvard University, the Mozilla Science Lab at the Mozilla Foundation, University of Washington, and the Science Gateways Community Institute at the San Diego Supercomputer Center.

We launched our workshop website at http://hackathon-workshop-2018.com. The workshop was also advertised through several communication channels, such as CHI 2018 conference's website, the "Researchers of the Socio-Technical" Facebook Group, the CSCW and chi-

announcements mailing lists, and invitations to our previous workshop participants. All workshop applicants were asked to submit a 2-4 page paper describing their interest in one or more of the workshop themes, presented as a research idea or a story that drew from their own event experience. After the paper submission deadline, members of the organizing committee and authors of submitted position papers were randomly assigned to submissions, and rated them on how well they represented the themes and their potential for discussion at the workshop. Each paper received at least two reviews. All accepted position papers can be found in **Appendix A** of this technical report.

Workshop Activities

A total of 21 participants representing 15 institutions attended the workshop. 48% of participants were female, and 52% were male. The workshop started with a brief introduction by Jim Herbsleb, followed by a keynote presentation by Elizabeth Gerber. In her talk, she discussed the importance of accessing diverse knowledge and perspectives for open and collective innovation, and how hackathons could be a platform to foster knowledge exchange between people from diverse backgrounds. Moreover, she highlighted the importance of bringing together perspectives from human computer interaction, management science, design, manufacturing, and product development to drive innovation.

After this introduction, we conducted a general introduction session in which each participant introduced themselves and their interest in hackathons in 10 words. The introduction was followed by poster presentation session which aimed to facilitate a focused and interactive discussion among participants and encourage the development of new collaborations. During this poster session, participants had the opportunity to discuss mutual interest in more detail. Prior to the workshop, we had advised all participants to bring a poster containing a summarized description of their hackathon-related work or their submitted position papers. There was a total of 11 posters presented at the workshop and the poster session was divided into two 30-minutes sub-sessions. In the first session, the authors of the first 6 posters presented their work, giving the other workshop participants opportunities to discuss with authors of posters they were interested in. In the second session, the authors of the remaining 5 posters presented their work. All posters can be found in **Appendix B** of this technical report.

During the introduction and poster sessions, we collected ideas from participants which were clustered into three themes. These themes were then used as discussion topics for breakout groups. The following three themes emerged from this process: 1) organizing hackathons, 2) diversity and inclusion, and 3) measuring hackathon outcomes.

After a short lunch break, participants formed three groups around the previously-identified themes and each group explored their chosen theme in detail. This discussion session lasted 2 hours with a 30-minutes break in between. Each group was advised to use a Google Docs to record ideas resulted from their group discussion. At the end of this session, one person from each group presented a summary of their group work discussion. Each group presentation lasted about 10-15 minutes.

The breakout-group discussion session was followed by a 60-minute plenary session in which all participants proposed and discussed ideas and issues which could be considered to move hackathon research and practice forward. Part of this discussion were considerations of how to integrate hackathon-related research into the broader CHI and CSCW community including potential future research directions. In addition, participants also proposed materials which might be useful for practitioners, e.g., a tree-structured hackathon planning kit which guides hackathon organizers towards a suitable event design based on a set of questions (e.g., about their event goals). The workshop ended with a session during which all participants were asked to state one aspect of the workshop that they liked and one aspect that they wished to be different. During this session all participants sat in a circle together and took turns to share what they liked and what they wished to be different for a future workshop.

Results

In this section, we present the results of the discussion by each aforementioned breakout group.

Organizing Hackathons

This workgroup consisted of seven members, of which two were experienced event organizers, two were interested in putting on a scientific hackathon in the following summer, and the rest were PhD students studying hackathons. The purpose of this group was to compile resources that

could be helpful for future event organizers and discuss challenges related to the organization of hackathons.

The group started off with identifying and listing available **online guides for planning and organizing hackathons**. Examples of identified planning guides include the organizer guide[5] by Major League Hacking (MLH), an organization that organizes and supports hackathons with college students, and the hackathon planning guide by Gartner based on NASA's international annual hackathons[6]. Other hackathon organizing guides identified by this group can be found in **Appendix C** of this technical report.

In addition to planning guides, this group also documented several **online websites that list hackathon events and projects** including the names and other online profiles of team members. Examples include Devpost[7] in which organizers can post their events and participants use this space to submit their projects, and MLH[8] which lists all hackathons organized by MLH. Other online hackathon listing websites can be found in Appendix C of this technical report.

This group also explored a number of questions: what is a hackathon? what are the toolsets for organizing a hackathon? what does the period before an event look like for you? With regard to the question about what a hackathon is, one member asked "what are the design dimensions of a hackathon?" The group proposed that a hackathon consists of five major components: collective innovation, communication or documentation, education (training component), incentives, and skill application to projects. In addition, they regarded that hackathons are time-bounded and can lead to something new being built.

Regarding the second question, Je'aime specifically wondered if there were any tools or templates that event organizers could readily utilize. Other group members pointed out CHI for good events and a paper about "typology of hackathons" from our previous workshop which categorized hackathons into three types. Robert and Erin also provided some tips for how to get participants motivated with the event. These include giving more awards than the participants

[5] MLH organizer guide. https://guide.mlh.io
[6] Gartner hackathon planning guide. https://www.gartner.com/smarterwithgartner/plan-a-successful-hackathon/
[7] Devpost hackathon listing. https://devpost.com/hackathons
[8] MLH hackathon listing. https://mlh.io/seasons/na-2018/events

would expect, having a "science fair" style project presentation at the event, and letting participants tell their stories as part of their hackathon outputs. Further, Robert mentioned that, based on the keynote presentation, the 6-week window period before and after the event is important for organizers to monitors event related activities including all preparatory work and follow up activities.

Diversity and Inclusion

The second workgroup consisted of seven members and the group discussed the challenges around diversity and inclusion in the context of hackathon. The group started off discussing the **boundary of hackathons**, and proposed that hackathons were time-bounded (but the meaning of "bounded" needed to be defined clearly), fast and scrappy (fidelity-based definition), intensive, face-to-face (in many cases) events, and can either be a long term or short term project, but they do not have to be coding and could also be editing, documentation, data, and work production. The group also noted that teams involved in hackathons are ad hoc in nature which creates particular diversity/inclusion challenges.

After defining the boundary of hackathons, the group brainstormed the **meaning of diversity and inclusion**. The identified diversity criteria include intellectual, ethic, gender, expertise, domain, family status (e.g., childcare availability at the event), and languages and skills, while the group defined accessibility, cost, family, and culture as criteria for inclusion. The group also noted that diversity is context specific depending on the purpose and expected participants of the hackathons. Sian added that hackathons are ritualistic and have been built around defined ideological tenets, so a simplification of diversity may be needed so that a person's identity isn't used to devalue their contributions.

In addition, the group also discussed using GenderMag[9] approach to encourage gender-inclusiveness in hackathons. In addition to a common way of assessing the level of diversity and inclusivity through self-reported measures, this workgroup also discussed how to measure the awareness of whose perspectives are not presented, especially when they have been systematically excluded. One proposed solution is to apply the critical mass theory, suggesting that a certain percentage of representation of minorities is needed in order for them to be able to

[9] GenderMag. http://gendermag.org

influence and involve in the engagement. For example, in the context of political science, 30% has been regarded as the crucial cut-off point for getting women involved in politics but this percentage can be reduced by more prominent women figureheads in the group [4].

The group then examined **how to promote leadership and positive inclusive role models** in hackathons. Their proposal includes having a woman leader and a representative leadership team who are valued for their diverse sets of experiences and skills. The group further noted that it is important to have a system in place to support broader recruitment and support for people of diverse identities. Regarding the need for a broader recruitment effort, the group made a few suggestions to achieve this. One is related to personal invitations and recruitment in pairs, enabling participants to feel psychologically safe by being able to come to the event with a person they trust. The following statement could be included in the recruitment message: "I'd love to invite you personally and I think you'd have a lot of fun if you bring a friend." Jim suggested an alternative model of "She Innovates"[10] hackathon hosted by the University of Pittsburgh. This is a women-only hackathon which serves as a means of preparing women to get involved in other events with more diverse people. This group also noted that a better connection between event organizers would be helpful to promote more cross-pollination between events.

The group also recognized the importance of **branding hackathons to be inclusive** and explored how to achieve this objective. Jim, Brad, and Liz provided useful guidelines to make the events more inclusive. These include having less emphasis on competition (e.g., following the event structure used by Codefest or Collaboration Fest [14] and Crowdcamp [2]), making explicit valuation of other skill sets in addition to coding, and assigning roles (i.e., role-based coordination) to facilitate greater team participation.

MLH suggests that another important way that non-coder women contribute to code-centric hackathons is utilizing their subject matter expertise. Figure 1 represents the participation of women in hackathon from MLH "Hackathon Data" talk at Hackcon IV[11]. The red bars represent the percentage of the US population in each group, the yellow bars represent the percentage of EECS majors in each group, and the blue bars represent the percentage of MLH hackathon

[10] She Innovates Hackathon. https://www.innovation.pitt.edu/events-competitions/she-innovates/
[11] MLH "Hackathon Data" talk at Hackcon IV, https://youtu.be/NJCfKG4tt5M

participants in each group. Notably, MLH hackathons had a higher percentage of female participants on average than EECS degree programs did. One possible explanation for this might be that among EECS majors, MLH hackathons were more likely to attract women, but MLH attributed it to the participation of non-EECS majors. In 2016, 20% of MLH hackathon participants had majors outside of EECS, and both women and African-Americans were disproportionately likely to have non-EECS majors.

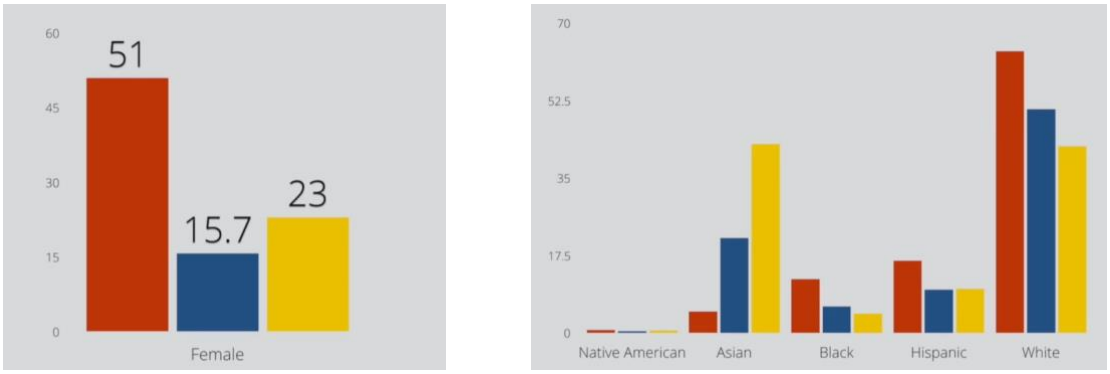

Figure 1. Women participation in hackathons from MLH "Hackathon Data"[11]

This group then discussed how and whether to include inclusiveness dimension as affirmative action plan in order to ensure that the event goal to attract diverse participants, rather than filling quotas. Related to this aspect, Jim pointed to the prior research work of Filippova et al. (2017) [9] in which the authors proposed brainstorming as a way of encouraging the participation of self-identified minorities in hackathons.

This group concluded their discussion with a provocative statement, "given the nature of hackathons, is it possible to have diverse hackathons? If the contention is, diversity occurs when people trust each other and are familiar with each other," then building up to the hackathon could lay the groundwork for diversity. The group also noted the need for design guidelines about how to make the hackathon event inclusive. The questions raised also include whether the duration of the event as well as funding for attending and event organizing are barriers to inclusivity.

Measuring Hackathon Outcomes

The third workgroup consisted of eight members and their discussion focused on **how to define the success from hackathons, how to measure outcomes, and how to sustain them**. Similar to the two groups mentioned above, this group also started their discussions by identifying key

characteristics of hackathons. This group identified the following aspects to be relevant: in order for an event to be considered a hackathon it has to be time-bounded, collaborative, multidisciplinary, product/development-driven, and supports participants to leave their comfort zone. Moreover, this group categorized hackathons into three different types:

- 1-off (come, hack, complete, done),
- recurring (come, join existing groups, hack, repeat), and
- progress-driven (propose desired outcome, hack, facilitate process, repeat until mature).

The group then proposed and discussed a number of possible quantitative and qualitative measures of hackathons. For each measure, the group identified suitable points of measuring specific outcomes: at the start of an event (SOE), at end of an event (EOE), and after the event has ended (EOE + T). The hackathon measures and associated points of measurement are listed in Table 1 below.

Table 1. Possible quantitative and qualitative measures of hackathons and suitable points of measuring

Measures	**Suitable points of measurement**
Quantitative measures	
Number of participants	SOE
Resumes/job interviews	EOE and EOE + T
Corporate promotions	EOE and EOE + T
Multidisciplinary collaborations/ “gaps bridged”	EOE
Human-hours of dedicated (sprint) work towards specific topic	SOE, EOE and EOE + T
Companies founded	EOE and EOE + T
Commits/repositories/organizations created on GitHub	SOE, EOE and EOE + T
Community members	EOE + T
Network evolution (i.e., weak ties, strengthen relationships, new positions)	SOE, EOE and EOE + T
Initial projects merged/combined	SOE and EOE
Publications/white papers/case studies contributed to	EOE + T

GitHub issues opened (i.e., bug reports/feature requests)	EOE
Lines of code produced and/or deleted, "newly exposed" products/tools (i.e., link clicks etc.)	EOE
Intentions formed/goal set and subsequently achieved	EOE and EOE + T
Qualitative measures	
The number of ideas	SOE and EOE
"Innovative" projects (i.e., unexpected and beyond scope of the task)	EOE and EOE + T
People who worked on a new discipline/platform/project	EOE
Applications of newly acquired skill within event	EOE
"Value" of things accomplished	EOE + T
Participation equity	EOE
Diversity of a community	EOE + T
Strength and confidence in abilities/efficacy in area of interest	SOE, EOE and EOE + T
The type/quality of group interaction	SOE, EOE and EOE + T
Street cred/change in social barriers	SOE and EOE
Percentage of satisfied/happy participants	EOE
Percentage of "spin-offs" or translated ideas	EOE and EOE + T

Discussion and Conclusion

Based on three breakout group discussion sessions and plenary session, several important things that are worthwhile to consider for both research and practice were identified. The majority of participants agreed that it would be helpful to have a decision tree that allows organizers to search for event design guidelines based on a set of minimal questions depicting their event goals or objectives. Participants also wished to have a collection of resources about lessons learned from previous events and training materials which would lower the barriers for organizers to run future events.

With regard to diversity and inclusion, there are some open questions regarding how to promote the aspect of diversity and inclusion in hackathons. How can we design effective inclusive

hackathons according to different outcomes? What evidence exists for different strategies? Which strategy is most effective? How do we measure the outcome of inclusive strategies such as feeling of inclusiveness? Could brainstorming be a model of inclusive hackathon? What motivates leaders to design for inclusion? How could the language of hackathons influence inclusion? What are the factors that detract from inclusivity and diversity at hackathons?

Other questions that are worthwhile to explore include how hackathons can be positioned in a broader theoretical space. Given the unique nature of hackathons, one might consider positioning hackathons as a new form of collocated work or the future of work [12]. Exploring the similarities and differences in event goals, participant's motivations and expectations, and outcomes across various types of hackathons such as civic, corporate, science, and collegiate. Further, hackathons could be positioned as one element of a collection of events, and their real goals are often to integrate with larger efforts (e.g., as a means to onboarding people to the process), especially in the case of hackathons for scientific community building.

Based on the feedback of "like and wish" session, we found that the participants were very positive about the experience provided by the workshop. The majority of participants expressed that they liked keynote presentation which laid some foundation of hackathons, as well as poster session which allowed them to meet and talk with people of similar interest in a more interactive manner, and less-formal breakout group discussion session which some participants wished to do it again next year. Participants also wished to extend the community beyond the workshop and produce a more concrete output such as an academic paper and technical report. A couple of participants wished that it would be good to run a pre-workshop survey to elicit participant's research interest beforehand. Interestingly, one participant wondered what would happen if this workshop is structured as a hackathon, i.e., applying the hackathon model to the workshop. Most participants found it useful to have both researchers and practitioners in the workshop and breakout groups. Taken together, our workshop was able to fulfil its purpose of facilitating the cross-fertilization of ideas by bringing in people with diverse perspectives, as well as future collaboration in this hackathon space.

References

1. Esteve Almirall, Melissa Lee, and Ann Majchrzak. 2014. Open innovation requires integrated competition-community ecosystems: Lessons learned from civic open innovation. Business Horizons 57, 3 (2014), 391–400. DOI: https://doi.org/10.1016/j.bushor.2013.12.009
2. Paul André, Michael Bernstein, Mira Dontcheva, Elizabeth Gerber, Aniket Kittur, and Rob Miller. 2012. CrowdCamp: rapidly iterating ideas related to collective intelligence & crowdsourcing. In CHI '12 Extended Abstracts on Human Factors in Computing Systems (CHI EA '12). ACM, New York, NY, USA, 2687-2690. DOI: https://doi.org/10.1145/2212776.2212696
3. Gerard Briscoe. 2014. Digital innovation: The hackathon phenomenon. Digital Creative works London.
4. Childs Sarah and Lena Krook Mona. 2008. Critical Mass Theory and Women's Political Representation. Political Studies 56, 3 (2008), 725–736. DOI: https://doi.org/10.1111/j.1467-9248.2007.00712.x
5. Adrienne Decker, Kurt Eiselt, and Kimberly Voll. 2015. Understanding and improving the culture of hackathons: Think global hack local. In Frontiers in Education Conference (FIE), 2015 IEEE (pp. 1-8). IEEE. DOI: 10.1109/FIE.2015.7344211
6. Marthe Dehli. Hackathons as a ground for creating start-ups: Evidence from THE Port 2014. Ph.D. Dissertation. CERN.
7. Margaret Drouhard, Anissa Tanweer, and Brittany Fiore-Gartland. 2017. A typology of Hackathon Events. Paper presented at the First Workshop on Hacking and Making at Time-Bounded Events, Conference on Computer-Supported Cooperative Work and Social Media. Retrieved from https://hackathon-workshop.github.io
8. Anna Filippova, Brad Chapman, R. Stuart Geiger, James D. Herbsleb, Arun Kalyanasundaram, Erik Trainer, Aurelia Moser, and Arlin Stoltzfus. 2017. Hacking and Making at Time-Bounded Events: Current Trends and Next Steps in Research and Event Design. In Companion of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17 Companion). ACM, New York, NY, USA, 363-370. DOI: https://doi.org/10.1145/3022198.3022658
9. Anna Filippova, Erik Trainer, and James D. Herbsleb. 2017. From diversity by numbers to diversity as process: supporting inclusiveness in software development teams with brainstorming. In Proceedings of the 39th International Conference on Software Engineering (ICSE '17). IEEE Press, Piscataway, NJ, USA, 152-163. DOI: https://doi.org/10.1109/ICSE.2017.22
10. Allan Fowler. 2016. Informal STEM Learning in Game Jams,zHackathons and Game Creation Events. In Proceedings of the International Conference on Game Jams, Hackathons, and Game Creation Events (GJH&GC '16). ACM, New York, NY, USA, 38-41. DOI: http://dx.doi.org/10.1145/2897167.2897179
11. Sean Goggins, Andrea Wiggins, Susan Winter, and Brian Butler. OCData Hackathon @ CSCW 2014: online communities data hackathon, Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing, February 15-19, 2014, Baltimore, Maryland, USA. DOI: 10.1145/2556420.2558865
12. Aniket Kittur, Jeffrey V. Nickerson, Michael Bernstein, Elizabeth Gerber, Aaron Shaw, John Zimmerman, Matt Lease, and John Horton. 2013. The future of crowd work. In Proceedings of

the 2013 conference on Computer supported cooperative work (CSCW '13). ACM, New York, NY, USA, 1301-1318. DOI: https://doi.org/10.1145/2441776.2441923

13. Marco Komssi, Danielle Pichlis, Mikko Raatikainen, Klas Kindström, and Janne Järvinen. 2015. What are Hackathons for? IEEE Software 32, 5 (2015), 60-67. DOI: 10.1109/MS.2014.78
14. Steffen Möller, Enis Afgan, Michael Banck, Raoul JP Bonnal, Timothy Booth, John Chilton, Peter JA Cock, Markus Gumbel, Nomi Harris, Richard Holland, Matúš Kalaš, László Kaján, Eri Kibukawa, David R Powel, Pjotr Prins, Jacqueline Quinn, Olivier Sallou, Francesco Strozzi, Torsten Seemann, Clare Sloggett, Stian Soiland-Reyes, William Spooner, Sascha Steinbiss, Andreas Tille, Anthony J Travis, Roman Valls Guimera, Toshiaki Katayama, and Brad A Chapman. 2014. Community-driven development for computational biology at Sprints, Hackathons and Codefests. BMC bioinformatics 15, 14, S7. DOI: https://doi.org/10.1186/1471-2105-15-S14-S7
15. Arnab Nandi and Meris Mandernach. 2016. Hackathons as an Informal Learning Platform. In Proc. SIGCSE '16, 346-351. https://doi.org/10.1145/2839509.2844590
16. Alexander Nolte, Ei Pa Pa Pe-Than, Anna Filippova, Christian Bird, Steve Scallen, and James D. Herbsleb. 2018. You Hacked and Now What?: - Exploring Outcomes of a Corporate Hackathon. Proc. ACM Hum.-Comput. Interact. 2, CSCW, Article 129 (November 2018), 23 pages. DOI: https://doi.org/10.1145/3274398
17. Ei Pa Pa Pe-Than, Alexander Nolte, Anna Filippova, Christian Bird, Steve Scallen, and James D. Herbsleb. (Accepted). Designing Corporate Hackathons With a Purpose. IEEE Software. DOI: 10.1109/MS.2018.290110547
18. Emily Porter, Chris Bopp, Elizabeth Gerber, and Amy Voida. 2017. Reappropriating Hackathons: The Production Work of the CHI4Good Day of Service. In Proc. CHI '17, 810-814. DOI: https://doi.org/10.1145/3025453.3025637
19. Arlin Stoltzfus, Michael Rosenberg, Hilmar Lapp, Aidan Budd, Karen Cranston, Enrico Pontelli, Shann Oliver, and Rutger A. Vos. 2017. Community and Code: Nine Lessons from Nine NESCent Hackathons [version 1; referees: 1 approved, 1 approved with reservations]. F1000Research 2017, 6:786. DOI: https://doi.org/10.12688/f1000research.11429.1
20. Erik H. Trainer, Arun Kalyanasundaram, Chalalai Chaihirunkarn, and James D. Herbsleb. 2016. How to Hackathon: Socio-technical Tradeoffs in Brief, Intensive Collocation. In Proc. CSCW '16, 1118–1130. DOI: https://doi.org/10.1145/2818048.2819946

Appendix A

Position Papers

Appendix B

Posters

Appendix C

Online Guides on Organizing Hackathons

Major league hacking (MLH) – an organization that primarily organizes student hackathons affiliated with universities

- https://mlh.io/event-membership
- https://guide.mlh.io/

Gartener – the planning kit derived based on NASA's international annual hackathons

- https://www.gartner.com/smarterwithgartner/plan-a-successful-hackathon/

Socrata

- https://socrata.com/open-data-field-guide/how-to-run-a-hackathon/

Rally team

- https://rallyteam.com/blog/

Hackathon: Your guide to running a hackathon by J Mac

- https://www.amazon.ca/Hackathon-Your-guide-running-hackathon-ebook/dp/B00JLT24BY

Guide to civic hackathons from DC – based on five successful years of open data day D

- https://hackathon.guide/

CHI Hacknight

- https://chihacknight.org/blog/2015/11/23/10-lessons-from-organizing-the-chi-hack-night.html

Online Listing of Hackathons

Devpost – https://devpost.com/hackathons

- LinkedIn competitor for Hackathon → organizers are free to post hackathons, participants can use it to submit their projects to hackathons

Eventbrite - https://www.eventbrite.com

- Generic event website, you can keyword search for "hackathon"

Hackathon.com – https://www.hackathon.com/

- Just found this with a Google search, but it seems to have event listings

MLH – https://mlh.io/seasons/na-2018/events

- Major League Hacking list of events for the 2017-2018 school year